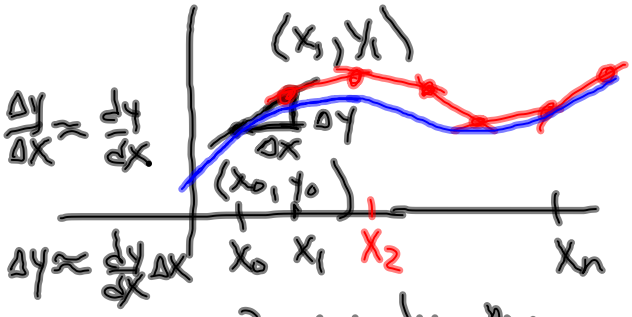
6.1 Euler's method

numerical solution to d.e.

given d.e. $\frac{dy}{dx} =$ ——

initial conditions (x_0, y_0)

find (x_n, y_n)



$\frac{\Delta y}{\Delta x} \approx \frac{dy}{dx}$

$\Delta y \approx \frac{dy}{dx} \Delta x$

$y_1 = ?, \; y_0 + \frac{dy}{dx} \cdot \Delta x$

$x_1 = x_0 + \Delta x$

$x_2 = x_1 + \Delta x$

$y_2 = y_1 + \frac{dy}{dx} \Delta x$

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Euler's method

$$y_{n+1} = y_n + \frac{dy}{dx} \cdot \Delta x$$

$$y_{n+1} = y_n + f'(x, y) \Delta x$$

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Ex.

$\frac{dy}{dx} = x + y \qquad y(2) = 0 \qquad x = 2,\ y = 0$

$y(3) = ?$ $\approx$ 3.46496

$\Delta x = .2$

	x	y	y'
x_0	2	y_0 0	2
x_1	2.2	y_1 .4	2.6
x_2	2.9	y_2 .92	3.32
x_3	2.6	y_3 1.584	
x_4	2.8	2.4008	
x_5	3	3.46496	

new old + $y' \cdot \Delta x$

$y_1 = y_0 + y' \cdot \Delta x$

$y_1 = 0 + 2(.2) = .4$

$y_2 = y_1 + 2.6(.2) =$

$.4 + .52 = .92$

$y_3 = .92 + 3.32(.2) =$

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$\frac{dy}{dx} = 2x - y \qquad x = 2 \qquad y = 3 \qquad f(1.5) = ?$

$\Delta x = -.1$

x	y	y'
2	3	1
1.9	2.9	
1.8		
1.7		
1.6		
1.5	2.61051	

$y' = 2 \cdot 2 - 3 = 1$

$y_1 = 3 + 1(-.1) = 2.9$

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